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A graphic representation of these changes in connection with the curves of hydration, will enable us to determine the relation of growth and seasons to hydration of tissues. This comparison will show most conspicuously that that period at which growth for the season is chiefly terminated, is nearly coincident with the period of maximum tissue hydration, the former being but five or ten days later than the latter.

From the foregoing facts the following appear to be the general laws :

1st. The hydration of woody plants is not constant for all seasons, and depends upon conditions of growth.

2d. The hydration reaches its maximum during the latter part of May or early June, and its minimum during the month of January.

3d. Hydration is greatest in the sap wood ; least in that which is older.

4th. Greatest hydration is directly correlated to most active growth of the plant ; lignification and storage of starch and other products being correlated to diminishing hydration.

These facts apply only to latitudes lying between New York and Boston. For other latitudes, certain modifications might be necessary.

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DOMESTICATION OF THE GRIZZLY BEAR.

BY JOHN DEAN CATON, LL.D.

THE family of bears is among the most widely distributed groups of the quadrupeds, and is represented by a number of living species. They occupy the polar regions of the north and the temperate and torrid regions of both hemispheres. Some are of enormous strength and fierceness, others are diminutive and comparatively mild in disposition. Nearly every species has been held in captivity in considerable numbers, yet of their adaptability to domestication but little of real scientific value has been written, and I think I may add but little is known, for the want of judicious experiment and careful observation.

They are sometimes met with in the streets in various countries, exhibited by street showmen, who have taught them various amusing tricks, evincing considerable intelligence and docility,

but these are generally of the smaller and milder species, and but little of their training or domestication has been recorded.

Those which have been exhibited in gardens or menageries, as a general rule, are merely held in confinement, and not in domestication, so that little can be learned from them of their adaptability to complete subjection to human control. This can only be learned by long-continued experiments and observations under favorable circumstances by those whose tastes and inclinations fit them for the task.

My attention was called to this subject by reading the "Adventures of James C. Adams," who was a celebrated hunter of California, who seems to have had a genius for capturing and domesticating wild animals. Among others he fairly domesticated quite a number of the grizzly bear (*Ursus ferox* Lewis and Clark) with complete success. This is the largest and fiercest known of all the species, and it might be expected the most intractable or unsubmitive to human control, yet such appears not to have been the case.

The first specimens experimented with were two cubs, over a year old when caught, taken in Washington Territory, between Lewis and Clark's fork of the Columbia. They were brother and sister; the latter was retained by Adams, and his experiments were principally conducted on her, which he called "Lady Washington." She seems to have been the more tractable and submissive. The male he parted with to a friend, after he had received but the rudiments of his education. At first they were chained to trees near the camp-fire, and resisted all attempts at familiarity and kindness; then severity was adopted, until they finally submitted.

Soon after the male was parted with, and we have no account of his subsequent career. The female was always after treated with the utmost kindness, and in a few months became as tractable as a dog. She followed her master in his hunting excursions, fought for him with other grizzlies, and saved him from the greatest perils.

She slept at his feet around the camp-fire, and took the place of a most vigilant watch-dog. He taught her to carry burdens with the docility of a mule, and as she grew up her great strength enabled her to render him great assistance in this way.

Another bear of the same species he captured in the Sierras in

California, before its eyes were open, and raised it on a grayhound bitch in company with her own pup. This he called Ben Franklin, and proved more docile even than the first. He never found it necessary to confine in any way this specimen, but he was allowed to roam and hunt with his foster brother, the grayhound. They were inseparable companions, and seemed to have as much affection for each other as if they had been of the same species. Before he was full-grown, when his master was attacked by a wounded grizzly, he joined in the fight with such ferocity as to save his master's life, and though he was severely wounded in this contest, with careful nursing he survived, and ever after showed as much courage in attacking his own species as if he had not met with this severe punishment.

He seems to have had less confidence in Lady Washington, for she was generally kept chained during the night and when on the journey, though allowed to follow free when on the hunt. This may be explained by the fact that she was over a year old when captured, while the other never had any taste of wild life.

When she was chained up near the camp-fire in the Rocky mountains, she was visited several nights by a large wild bear, which her master refused to disturb, and she, in due time, bore a cub, which grew to maturity under the tuition of her owner, and which he called Fremont, which he says manifested considerable intelligence and sagacity, but not equal to that of his dam or to his favorite, Ben Franklin. It is to be regretted that exact dates are not given from which we can determine precisely the period of gestation, but by comparing all the dates that are given, it may be stated provisionally that that period was nine months.

It has been stated by good authority that no instance has been known of any member of the bear family having bred in domestication, and this is the only instance where I have found such an event recorded or heard it stated.

Our author raised many of these animals, but generally disposed of them before they reached maturity, but he gives us no particulars except in these two instances.

He found the black bear, when raised in camp, as readily domesticated as the grizzly, and as fond of his society, following him about the camp and through the woods with fidelity and attachment.

It is certainly interesting to observe how completely the savage nature of these ferocious animals was overcome in those which were born in a wild state, and it would be interesting to know what modifications might be made in succeeding generations by domestication, an experiment which could only be successfully tried under favorable conditions, which do not exist with the great number of animals of this genus now held in confinement. I may remark here a wide difference in the effect of domestication upon the disposition of this animal and many others, which in the wild state show no ferocity, but only timidity. Take the Cervidæ, for instance, when brought up by hand; they lose all fear of man; they develop a wickedness and ferocity never manifested in the wild state; while the bears, so terrible when untamed, show docility, constancy and affection when brought into close familiarity with man. They seem to appreciate his kindness and care, and repay it with attachment and devotion, while the other class of animals, which are not ferocious by nature, seem to be entirely unappreciative of kindness, or at least seem incapable of continued personal attachment to the hand that feeds them.

When I first read Mr. Adams' adventures, I considered it an interesting romance, or at least that it was largely embellished by an ingenious imagination, but upon inquiry in San Francisco, I met reliable persons, who had known him well, and had seen him passing through the streets of that city, followed by a troop of these monstrous grizzly bears unrestrained, which paid not the least attention to the yelping dogs and crowds of children which closely followed them, giving the most conclusive proof of the perfect docility of the animals. Indeed, they were so well trained that they obeyed implicitly their master's every word or gesture in the midst of a crowded city, with surroundings which we might suppose would have aroused their native ferocity, if that were possible. After the most careful investigation I became convinced of the reliability of the narrative, and as the facts our author gives are interesting to science, I venture to repeat them, regretting, however, that he did not appreciate the great value of his observations, since he might have given us more particulars which must have come under his observation; but so it is that a vast majority of those who have good opportunities for observing do not know how to observe judiciously, or do not record their observations.

Mr. A. S. Kent, of San Rafael, California, who for many years, on account of his health, spent several months each year in camp life in the mountains, principally hunting the deer, informed me that he once purchased a couple of cubs of the grizzly bear, which he took into camp with him. One of these proved very docile and tractable, and seemed fond of his attention and society, and usually slept contentedly at his feet. The other seemed possessed of a much more vicious disposition, and he was obliged to kill it. Possibly this might have been overcome by patient care and judicious training.

There is no doubt that different dispositions among these animals as among most other, may be met with.

Mr. Kent's observations tend, in some degree at least, to confirm those of Mr. Adams.

May we not hope that some one with the necessary taste and proper facilities will try experiments and give us the benefit of their observations?

A complete monograph of any one of our species of bears under all conditions would be a valuable addition to our zoölogical literature.

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ON THE NATURE AND ORIGIN OF THE SO-CALLED "SPIRAL THREAD" OF TRACHEÆ.

BY A. S. PACKARD.

WHILE we owe to Professor O. Bütschli the discovery of the mode of origin and morphology of the tracheæ, which as he has shewn¹ arise by invaginations of the ectoblast; there being originally a single layer of epiblastic cells concerned in the formation of the tracheæ; we are indebted to Professor A. Weismann² for the discovery of the mode of origin of the "intima," from the epiblastic layer of cells forming the primitive foundation of the tracheal structure. We are also indebted to Weismann for the discovery of the mode of origin of the terminal tracheal cells.

Weismann did not observe the earliest steps in the process of formation of the stigma and main trunk of the tracheæ, which Bütschli afterwards clearly described and figured.

Weismann, however, thus describes the mode of development

¹ Zur Entwicklungsgeschichte der Biene. Zeit. wissen. Zoologie, xx, 519, 1870.

² Die Entwicklung der Dipteren im Ei. Zeit. wissen. Zoologie, xiii, 1863.